Advancing the Science of Emergency Department Crowding: Measurement and Solutions

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Emergency department (ED) crowding is one of the most important issues facing the United States today. It is emblematic of the systematic problems in the delivery of efficient, high-quality medical care: demand for services frequently exceeds supply. As a result, patients often have to wait to see emergency physicians, obtain critical treatments and test results, and board on ED hallways while awaiting inpatient beds. Crowding is not only inconvenient but also reduces quality of care and worsens outcomes.[1,2] ED patients have become the unfortunate "canaries in the coal mine" in a dysfunctional health care system. This issue of *Annals* tackles 2 of the biggest issues in ED crowding, the relationship between crowding and delays in care, and presents evidence on 2 effective solutions.[3-5]

Much like the old adage about obscenity, when it comes to crowding, emergency physicians "know it when we see it." But in reality, crowding has proven difficult to measure. McCarthy et al[3] elegantly deconstruct the association between static crowding measures (waiting room number, census, number boarding, and inpatient occupancy) and several intervals experienced by ED patients: waiting room, treatment, and boarding time. The findings seem intuitive: as more people wait to be treated, intervals lengthen: the longer the line, the longer the wait. This fundamental principle is also illustrated in work describing the relationship between crowding (waiting lines) and delays in patient care.[6-8] However, the greater effect is their identification of the precise intervals that lengthen during episodes of crowding, notably, waiting room time and boarding time. Although it is reassuring that the treatment time is least affected, both waiting and boarding are high risk. Both represent times at which disease can rapidly evolve and go unnoticed, exposing patients to preventable adverse events. Recall the last Monday afternoon in your ED: it is likely that high-risk patients waited for extended periods before seeing a physician, and some suffered in severe pain. ED patients already medically ready for inpatient care languished while waiting for hospital beds, far away from inpatient physicians while the ED team did their best to juggle the care needs of those waiting and those of new patients. Such is the state of 2009 ED care. Crowded EDs are a recipe not only for poor satisfaction (patient and provider) but also poor outcomes; in fact, it can set the stage for catastrophe. The most extreme form is when patients die in a crowded waiting room.

Another notable finding by McCarthy et al[3] is the variable effect crowding has across sites and intervals. For example, the same ED occupancy had different effects on throughput in EDs of similar size and volume. If we accept that the patient's view of time in the ED—waiting, treatment, and boarding—is criterion standards, this variable-effects finding indicates that static measures such as occupancy may not generalize as the best measures of ED crowding. Although many crowding researchers have sought a tool to predict and forecast crowding, perhaps a simpler approach is to measure actual intervals. For example, knowing that recent intervals are trending up (such as boarding time or radiology turnaround time during the past few hours), directed interventions may be deployed to fix the problem in real time before one bottleneck spirals an entire ED into gridlock.

In contrast to the McCarthy et al[3] work, Viccellio et al[4] share a much anticipated report detailing the experience of moving boarded patients to inpatient hallways. Their work is grounded in the fact that patients prefer inpatient hallways to ED hallways.[9] Vicellio et al[2] leveraged this by using a "shared boarding" approach by moving hospital capacity issues to hospital hallways. The authors report good outcomes when carefully selected patients are chosen for temporary inpatient hallway placement, using a full-capacity protocol. However, the real effect is to change the power balance between inpatient floors and the ED. The full-capacity protocol ensures that inpatient units are not shielded from hospital overflow and can be negatively affected by their own inefficiency. During peak capacity, this changes the inpatient unit's attitude toward flow. Rather than the ED refusing new patients, incentives are better aligned to improve throughput in inpatient units to ensure that ED patients won't require inpatient hallway beds. The result is

better flow through the entire hospital. It also serves to make overflow (ie, the boarding patients in need of care) a hospital problem as opposed to an ED problem. With their full-capacity protocol, only 4% of patients in the report actually went to inpatient hallways. It is unlikely the ED was crowded only 4% of the time; more likely, a full-capacity protocol changed behavior enough to limit the need to actually use it, a strong social effect.

What is even more interesting is their ability to overcome the political hurdle: getting inpatient and administrative partners to consider this effort. The authors did this by strategically gaining approval in advance from the New York Department of Health. Their success underscores the feasibility and safety of full-capacity protocols and should also assuage fears that providers outside the ED will revolt in this new patient-centered care model.

The second article on crowding solutions, by Dickson et al,[5] describes the experience of implementing the Lean process improvement strategies of Toyota in 4 EDs. The goal of Lean is to remove non–value-added steps from processes. The ED is a perfect place for this. For many patients, only a small proportion of the time in the ED truly adds value; in fact, most time in the ED is spent waiting for something (triage, for a physician, nurse, medication, consultant, test, or bed). Not surprisingly, removing non–value-added steps enhances both ED flow and satisfaction.

The Dickson et al[5] article also demonstrates a core business principle: implementing a culture change is highly dependent on leadership and engagement by frontline providers. Although it is easy to suggest improvements in the ED, affecting change is a different story. To succeed, ED leaders must create a culture of process improvement in which all stakeholders become invested. But Lean is not a magic bullet. As the authors found, Lean can and will fail without leadership or buy-in.

As the public reporting systems for ED quality and flow expand, there will be an increased mandate to deliver efficient, high-quality care. Using Lean to reduce waiting times and full-capacity protocols to reduce boarding can be effective solutions and a "win-win" all around. Patients win when they receive prompt, quality care. ED providers win when they believe they have sufficient resources to deliver efficient care. The hospital wins because a more efficient ED can treat more patients (and bill more), with similar staffing levels, plus have patients who *want* to return should illness recur. Additionally, the hospital wins as more patients seek all forms of care, including high-margin elective care.

There are several next steps from a policy perspective. Policies in the United States may force hospitals to follow strict throughput standards such as the UK 4-hour rule, which requires that patients spend 4 hours or fewer in the ED. In addition, given recent data that demonstrate that ED boarding may actually be profitable (because elective admissions are more profitable than ED admissions), payers may eliminate the incentive to use boarding because of its clear risk to patient safety.[10,11] This may be done by either permitting hospitals to bill inpatient hospitalizations only when patients arrive on hospital floors (as opposed to including bed request and boarding time in the admission time) or refusing payment for admissions for patients who board in the ED beyond a fixed period (such as 2 to 4 hours).[10,11]

From a research perspective, the next step is "comparative effectiveness" of ED interventions to increase throughput, safety, and satisfaction. By relying on a model that uses several waiting times, quality, and satisfaction as outcomes, effective research will compare interventions and allow the development of best practices for ED structure. Assembling this list will arm ED and hospital leaders with the information to know precisely where to invest time and resources to improve ED care. The 3 articles in this issue of *Annals* advance our understanding of ED crowding, but there is clearly more work to be done.

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